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SPECIFICATION FOR INSTRUMENT JEWELS

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SPECIFICATION FOR INSTRUMENT JEWELS

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SPECIFICATION FOR INSTRUMENT JEWELS

0. FOREWORD

0.1 This Indian Standard was adopted by the Indian Standards Institution on 30 December 1976, after the draft finalized by the Optical and Mathematical Instruments Sectional Committee had been approved by the Mechanical Engineering Division Council.

0.2 Jewels are used as bearing in precision instruments and control devices where minimum of friction, non-magnetic properties, chemical stability and long life is required.

0.3 For the purpose of deciding whether a particular requirement of this standard is complied with, the final value, observed or calculated, expressing the result of a test, shall be rounded off in accordance with IS : 2-1960*. The number of significant places retained in the rounded off value should be the same as that of the specified value in this standard.

1. SCOPE

1.1 This standard lays down the dimensions, general requirements and tests for jewels used in instruments.

2. TYPES

2.1 The jewels shall be of the following types:

a) V-jewels	Used with conical pivots and which have a V-shaped cavity
b) Ring jewels	Used as radial bearing in instruments
c) Compass/cup jewels	These are of three forms, used with pivots having spherical radius and the jewels also have the spherical cavity
d) End-stone jewels	Used alone or in combination with ring jewels

---

*Rules for rounding off numerical values (*revised*).

3. DIMENSIONS

3.1 The forms and dimensions of jewels shall be as given in Tables 1 to 6.

4. MATERIAL AND CHARACTERISTICS

4.1 The jewels shall be made from synthetic ruby or synthetic sapphire.

4.2 The hardness of the material shall be not less than 8 on Moh's scale or 1 800 to 2 000 on Knoop's scale.

5. WORKMANSHIP AND FINISH

5.1 The jewels shall be free from flaws, such as, dents, scratches, cracks, air cavities, gas bubbles, specks, surface defects, feathers, internal strain and optical inhomogeneity.

5.2 The jewels shall be highly polished and edges shall be rounded off or chamfered.

5.3 Ovalness and conicity of the outer diameter of the jewels shall be within half of the permissible tolerance on the outer diameter. This shall be in addition to the specified tolerance.

5.3.1 Non-parallelism of the plane faces more than 0·01 mm shall not be permissible.

5.3.2 Deviation from the perpendicularity of the nonworking plane face and cylindrical surface shall not exceed one degree.

5.3.3 Eccentricity of the cavity portion of the jewels with respect to the external diameter shall not be more than 0·02 mm.

5.3.4 Profile of the cavity portion of jewels shall be symmetrical to the axis of the jewels.

6. TESTS

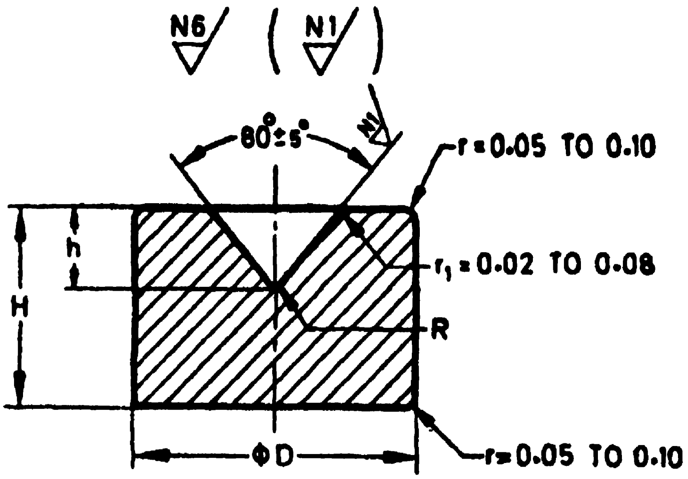
6.1 Freedom from Defects — The material shall not show any defects given in **5.1** when tested under binocular polarizing microscope having magnification at least 50×.

6.2 Curvature Radius — The radius of curvature of the surface shall be measured by means of a microscope equipped with an illuminated objective and an eyepiece with a graticule scale. The jewel shall be placed centrally on the stage and focused so that the image of the illuminated objective shall be observed in the mirror formed by the polished cup. The diameter of the image is proportional to the radius of curvature when measured on the eyepiece scale. The latter shall be checked up by measuring the size of the image seen in a small polished sphere of known diamater, such as, 1·6 mm diameter steel ball.

TABLE 1 DIMENSIONS FOR V-JEWELS

(*Clause* 3.1)

All dimensions in millimetres.

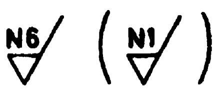


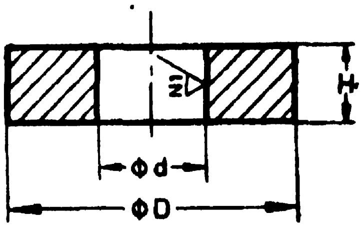
Designation	*D* − 0·02	*R*		*H* − 0·05	*h* ± 0·05
1·0 x 0·04	1·0	0·04	± 0·02	0·8	0·3
1·0 x 0·08		0·08			
1·0 x 0·10		0·10			
1·25 x 0·04	1·25	0·04		1·0	0·4
1·25 x 0·08		0·08			
1·25 x 0·125		0·125			
1·5 x 0·04	1·5	0·04		1·0	0·6
1·5 x 0·08		0·08			
1·5 x 0·10		0·10			
1·5 x 0·15		0·15	± 0·05	1·20	
1·5 x 0·20		0·20			
1·5 x 0·25		0·25			
1·8 x 0·15	1·8	0·15		1·5	
1·8 x 0·20		0·20			
1·5 x 0·25		0·25			
2·0 x 0·125	2·0	0·125		1·5	0·8
2·0 x 0·20		0·20			
2·0 x 0·30		0·30			
3·0 x 0·30	3·0	0·30		2·0	

TABLE 2 DIMENSIONS FOR RING JEWELS

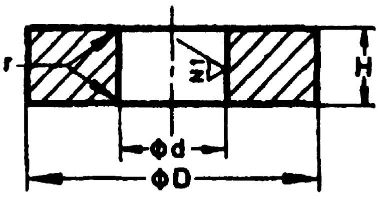
(*Clause* 3.1)

All dimensions in millimetres.



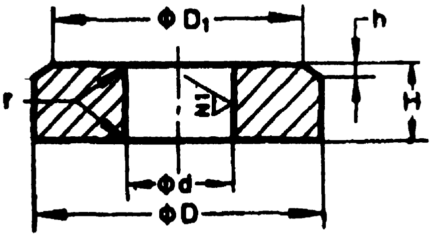


Type A



r=0.05 max.

Type B



r=0.05 max.

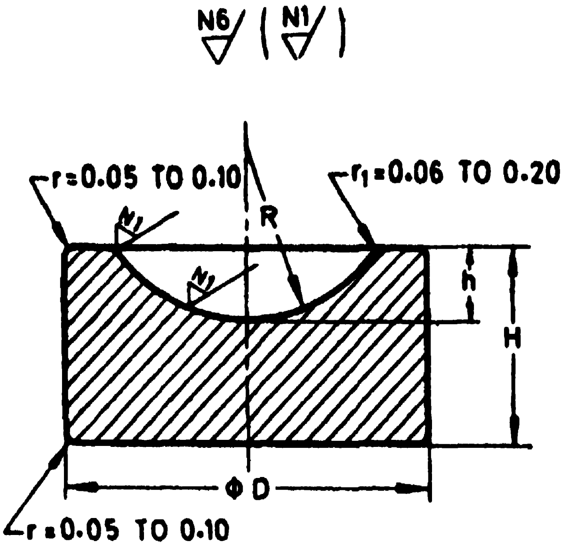
Type C

Designation	*d* + 0·014	*D* + 0·01	*H* + 0·01 − 0·02	*h* ± 0·025	D_1 ± 0·05
1·6 × 0·5	0·5	1·6	0·35	0·07	1·3
2·0 × 0·5		2·0	0·35		1·7
1·6 × 0·63	0·63	1·6	0·35		1·3
2·0 × 0·63		2·0	0·40		1·7
2·0 × 0·8	0·8	2·0	0·40		1·7
2·5 × 0·8		2·5	0·40	0·12	2·2
2·5 × 0·8		2·5	0·50		2·2
2·5 × 0·8		2·5	0·60		2·2
2·0 × 1·0	1·0	2·0	0·4	0·07	1·7
2·0 × 1·0		2·0	0·5		1·7
2·0 × 1·0		2·0	0·6		1·7
2·5 × 1·0		2·5	0·4	0·12	1·2
2·5 × 1·0		2·5	0·5		1·2
2·5 × 1·0		2·5	0·6		1·2
3·2 × 1·0		3·2	0·5	0·14	2·8
3·2 × 1·0		3·2	0·6		2·8
3·2 × 1·0		3·2	0·8		2·8
2·5 × 1·2	1·2	2·5	0·5	0·12	2·2
2·5 × 1·2		2·5	0·6		2·2
2·5 × 1·2		2·5	0·8		2·2
3·2 × 1·2		3·2	0·8	0·14	2·8

TABLE 3 DIMENSIONS FOR COMPASS OR CUP JEWELS, 'TYPE A'

(*Clause* 3.1)

All dimensions in millimetres.

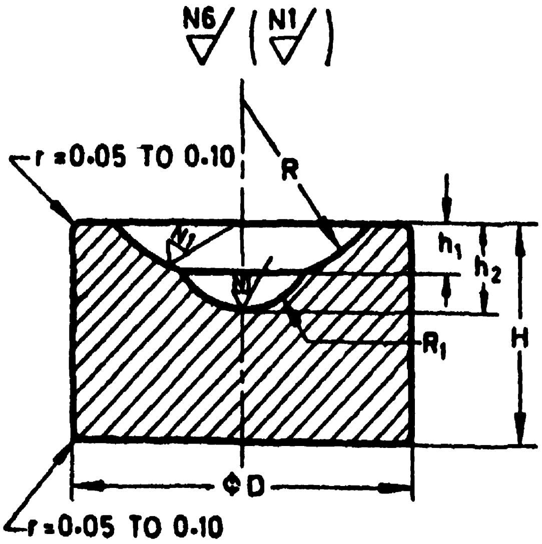


Designation	D		R ± 0·1	H ± 0·05	h ± 0·05
2·0 × 0·6	2·0	− 0·02	0·6	1·6	0·4
2·0 × 1·0	2·0		1·0	1·6	0·4
2·3 × 1·10	2·3		1·10	1·25	0·3
2·5 × 1·20	2·5		1·20	1·30	0·4
2·5 × 1·6	2·5		1·6	1·30	0·3
3·0 × 1·2	3·0		1·2	1·6	0·65
3·0 × 1·5	3·0		1·5	1·6	0·65
3·25 × 0·8	3·25		0·8	1·6	0·4
3·5 × 1·8	3·5	− 0·04	1·8	2·0	0·6
4·0 × 1·8	4·0		1·8	2·0	0·75

TABLE 4 DIMENSIONS FOR COMPASS OR CUP JEWELS, 'TYPE B'

(*Clause* 3.1)

All dimensions in millimetres.

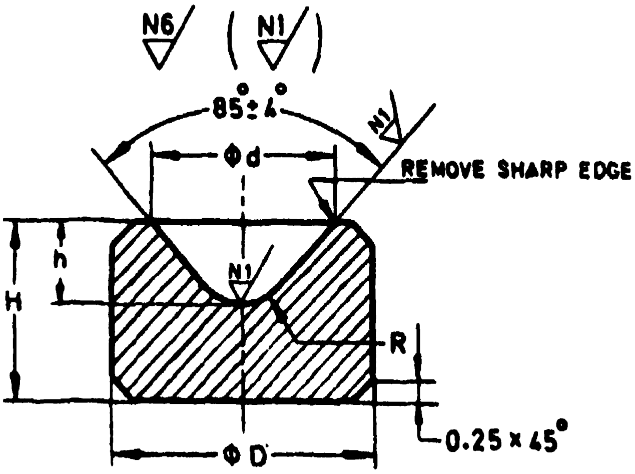


Designation	*D*		*R* ± 0·1	*H* ± 0·05	h_1 ± 0·05	R_1 ± 0·1	h_2 ± 0·05
2·5 × 1·2	2·5	− 0·02	1·2	1·5	0·5	0·3	0·7
3·0 × 1·5	3·0		1·5	1·6		0·4	0·8
3·75 × 1·90	3·75	− 0·04	1·90	2·25	0·6	0·80	0·9

TABLE 5 DIMENSIONS FOR COMPASS OR CUP JEWELS 'TYPE C'

(*Clause* 3.1)

All dimensions in millimetres.

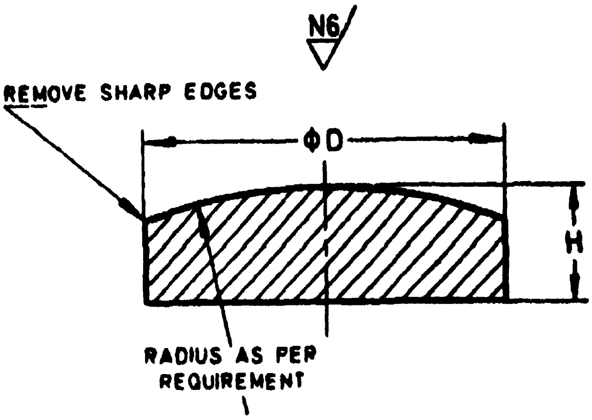


Designation	*D* ± 0·02	*H* ± 0·02	*d* + 0·03 − 0·02	*h* + 0·01 − 0·02	*R* + 0·02 − 0·03
2·85 × 0·54	2·85	1·38	2·0	0·85	0·54

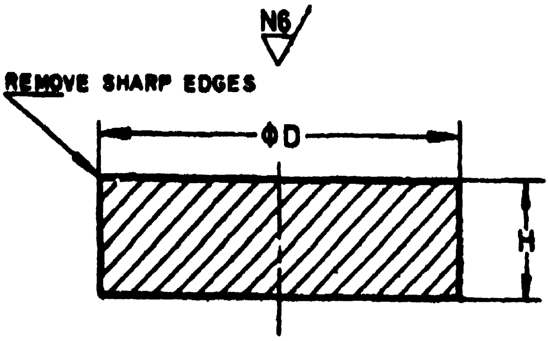
TABLE 6 DIMENSIONS FOR END STONES JEWELS

(*Clause* 3.1)

All dimensions in millimetres.



Type A



Type B

Designation	*D*		*H*	
1·25 × 0·25	1·25	− 0·02	0·25	− 0·04
1·25 × 0·5	1·25		0·5	
1·5 × 0·5	1·5		0·5	
1·5 × 0·8	1·5		0·8	
2·0 × 1·0	2·0		1·0	
2·5 × 0·8	2·5	− 0·04	0·8	− 0·1
2·5 × 1·0	2·5		1·0	
2·5 × 1·5	2·5		1·5	
3·0 × 1·0	3·0		1·0	
3·0 × 1·5	3·0		1·5	
3·5 × 2·5	3·5		2·5	
4·0 × 1·2	4·0		1·2	
4·0 × 2·0	4·0		2·0	
5·0 × 4·0	5·0		4·0	
5·0 × 5·0	5·0		5·50	

6.3 Height and Diameter — The diameter and the height of jewels shall be tested on the magnified image through projector having magnification 100 × or alternatively by a projection system as illustrated in Fig. 1 which could be made by suitably modifying a student spectrometer giving the requisite magnification and measuring accuracy.

6.3.1 A Ramsden positive eyepiece with magnification 10 × to 15 × and incorporating a graticule scale divided into millimetres and tenth millimetres shall be used for testing.

6.4 Dimensions and the Angle of Recess Cone of V-Jewels — It shall be measured with the aid of a projection apparatus giving the magnification of over 50 ×, the jewel being immersed in a fluid having a refractive index approximating to that for corundum (1·760 to 1·769). Two immersion fluids are commonly used for the purpose; namely methylene iodide (refractive index 1·74) and μ-bromonaphthalene, also known as alphabromide of naphthalene and monobromide of naphthalene (refractive index 1·66).

NOTE — Use of methylene iodide is recommended to enable precision measurements to be made for jewels of all sizes, no distortion due to the difference between the refractive index of this fluid and that of corundum having been observed. The μ-bromonaphthalene is more transparent than methylene iodide but is not recommended since its low refractive index is liable to introduce distortion into the projected image of the jewel cone and cup, for example, in the case of a jewel of 1·6 mm diameter an error of 3½° in 80° of recess cone angle has been observed. This distortion becomes progressively more extensive as the outside diameter of the jewel decreases.

7. MARKING

7.1 The label containing each pack shall be marked with the manufacturer's name or trade-mark, if any; type of jewels; quantity of jewels; and year of manufacture.

7.1.1 The packet may also be marked with the ISI Certification Mark.

NOTE — The use of the ISI Certification Mark is governed by the provisions of the Indian Standards Institution (Certification Marks) Act and the Rules and Regulations made thereunder. The ISI Mark on products covered by an Indian Standard conveys the assurance that they have been produced to comply with the requirements of that standard under a well-defined system of inspection, testing and quality control which is devised and supervised by ISI and operated by the producer. ISI marked products are also continuously checked by ISI for conformity to that standard as a further safeguard. Details of conditions under which a licence for the use of the ISI Certification Mark may be granted to manufacturers or processors, may be obtained from the Indian Standards Institution.

8. PACKAGING

8.1 The jewels shall be packed in a manner which will ensure proper identification. Jewels shall be so securely packed for storage and transit that there is no liability whatsoever for any deterioration or damage taking place.

8.2 Different types and sizes of jewels shall not be packed in the same packing.

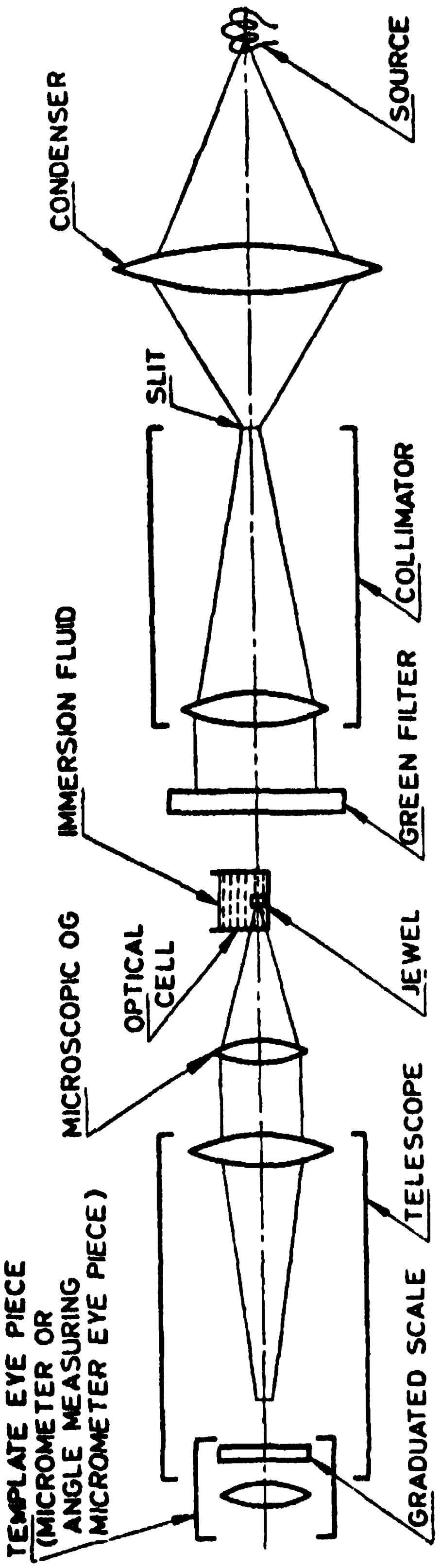


Fig. 1 Projection System

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TO
IS:8311-1976 SPECIFICATION FOR INSTRUMENT JEWELS

Alterations

(Page 4, clause 3.1) - Substitute the following for the existing clause:

'3.1 The recommended dimensions of various forms of jewels are given in Tables 1 to 6. For dimensions other than these, the tolerance limits as specified in Tables 1 to 6 shall apply.'

(EDC 36)

Reprography Unit, ISI, New Delhi, India